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SOURCE Vestnik Akademii Nauk SSSR, Vol XXIII, No 1, 1953, pp 42-46.SOME PROBLEMS OF VIROLOGY

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The methods applied in research on viruses differ from microbiological methods used in other fields. Whereas the microbiologist isolates bacteria and cultivates them in artificial nutrient media, the virologist is forced to isolate viruses by infecting plants or animals and to cultivate these viruses in organisms which are susceptible to them. This considerably complicates virological research. Although methods of cultivating viruses in vitro will probably be found, there is no reason to believe that the problem of growing viruses will be solved by applying procedures which are commonly used for bacteria.

Forms simpler than the cellular are already known among microbes. However, all microbes are protoplasts, i.e., living forms consisting of protoplasm, which is chemically heterogeneous matter possessing a colloidal structure and containing water. The virus nucleoproteids, which are devoid of water and lipoids, certainly cannot be regarded as protoplasts. A very interesting class of microorganisms close to viruses in size but different from them in structure as well as in their capacity to develop on artificial nutrient media are the so-called cystocytes. However, these are not being studied by virologists because they are not viruses, and are being neglected by microbiologists because they cannot be seen under the microscope. These remarkable and inadequately investigated organisms are possibly closer to the origin of life than viruses.

At present, the nature of protoplasm cannot be explained in terms of colloidal chemistry alone. The role of paracrystalline and crystalline molecular structures in protoplasm becomes clearer and the visible protoplasm structures can be explained more completely on the basis of structural properties of the molecules from which they are derived. The liquid crystals of the virus of tobacco mosaic disease may serve as models for the study of paracrystalline protoplasm structures. It is certain that a fuller knowledge of virus proteins will not only contribute to a better understanding of protoplasm structures but will also form the basis for the first attempts to prepare protoplasm artificially.

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Virus nucleoproteids are not only unique infectious agents, but also unique forms of life. They are compounds which can be easily isolated in their natural state and which in many cases crystallize with facility. The chemistry of nucleoproteids had not advanced very far prior to the discovery of viruses. Perhaps the significance of this discovery for the understanding of nucleoproteid chemistry is not being sufficiently realized. Before viruses were discovered, the presence of yeast nucleic acid was regarded as proof that the nucleoproteid containing this acid could not have been of natural origin. At present the opposite is true: no one doubts the natural origin of nucleoproteids which contain yeast nucleic acid, as virus nucleoproteids do. The easily soluble, crystallizing virus nucleoproteids furnish the most convenient model for an investigation of the structure of nucleoproteids and for a study of their interaction with various substances. This line of investigation was advocated by the author in connection with his work on the interaction of the virus of tobacco mosaic disease with dyestuffs and nucleic acids.

Some difficult problems of biochemistry have become more susceptible to solution since the discovery of virus proteins, for example, investigation of the biochemical basis of modifiability and of the biochemical conditions for the synthesis of specific nucleoproteids of protoplasm.

At present, viruses cannot yet be cultivated in vitro. Only an indirect approach to this problem is possible, and the priorities in connection with most of the work done in this field belong to the USSR. As a result of the investigations that have been carried out, viruses can be described as parasitic nucleoproteids which continue to accumulate under conditions of starvation of the host's organism and which are formed from substances that are simpler in constitution than proteins or nucleic acids. Substances which suppress the propagation of viruses have also been found; thus, a theoretical basis has been laid for the chemotherapy of virus diseases. The method of tagging with radioactive atoms is still being inadequately used in virological research. As a result of investigations on the physiology of viruses, methods for their artificial propagation will probably be developed. The investigations carried out so far have certainly brought us considerably nearer to a solution of this problem.

From the practical standpoint, measures against damage done by viruses are of considerable importance. Problems of the chemotherapy of virus diseases, as well as methods of treating virus diseases with antibiotics, should be the center of our attention. Work on the physiology of viruses has created the prerequisites for simplification of difficult, ponderous, and expensive research methods applied in the study of the chemotherapy of virus diseases.

The first special virological laboratories in the world were created in the USSR. The Institute of Virology is within the Academy of Medical Sciences USSR, so that its activities are primarily medical. The theoretical and practical importance of virology will undoubtedly necessitate an expansion of the network of virological institutions and result in a strengthening of existing institutions. The virological laboratory which functions within the framework of the Academy of Sciences USSR ought to become a research center well supplied with the qualified personnel and equipment needed to solve general biological problems pertaining to viruses.

Major stress should be placed on the training of virologists. In this respect virology, because it is a young science, meets with certain difficulties. Higher educational institutions do not give courses in virology. It is time to introduce such courses at universities and medical, veterinary, and agricultural institutions. Chairs of virology should be created at one or two of the largest universities. Also, there is still a need for entomologists who specialize in virological studies. When preparations were made for the first virological investigations requiring the participation of entomologists who specialize in

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virology, such specialists were not available. To meet the need, one of our collaborators /at the Laboratory of Plant Viruses, Institute of Microbiology, Department of Biological Sciences, Academy of Sciences USSR/ had to acquire a knowledge of entomology adequate for the virological investigations.

One of the current organizational tasks of USSR virology is creation of a special periodical devoted to problems of viruses and of other precellular forms of life.

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